Meiosis
DRAFT

Missouri Grade-Level Expectations (or other standards)

NGSS HS LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Learning Goal	Proficiency Scales
Students will be able to model sexual reproduction at a cellular level.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● diagramming the process of meiosis. ● diagramming the process of crossing over. 2: The student demonstrates he/she is nearing the learning goal by ● recognizing or recalling specific vocabulary, such as: gametes, variation, karyotype, homologous chromosomes, zygote, meiosis I, meiosis II, crossing over, synapsis, independent assortment. ● performing specific processes, such as: ○ describing the process of meiosis. ○ defining the process of crossing over. 1: Student demonstrates a limited understanding or skill with the learning goal.

Large Biological Molecules
DRAFT

Missouri Grade-Level Expectations (or other standards)

NGSS: HS-LSI-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Learning Goal

Students will be able to explain the processes regulated by large biological molecules.

Proficiency Scales

4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal.

3: The student demonstrates mastery of the learning goal by

- explaining the role of macromolecules in regulating chemical reactions in cells.
- explaining the storage of genetic information.

2: The student demonstrates he/she is nearing the learning goal by

- recognizing or recalling specific vocabulary, such as: protein, amino acid, peptide bond, 4 levels of protein structure,chaperonin,nucleic acids, DNA, RNA, nucleotide, purine, pyrimidine, and antiparallel.

	● performing specific processes, such as ○ labeling major macromolecules in the cell. ○ explaining the Central Dogma of Protein Synthesis. 1: Student demonstrates a limited understanding or skill with the learning goal.

Inheritance

DRAFT

Missouri Grade-Level Expectations (or other standards)

NGSS HS-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Learning Goal	Proficiency Scales
Students will be able to mathematically demonstrate the inheritance of traits.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● applying advanced, discipline-specific vocabulary in describing Mendelian genetics. ● solving genetics problems using Punnett Squares. ● making mathematical predictions about phenotypes in future

	generations. 2: The student demonstrates he/she is nearing the learning goal by ● recognizing or recall specific vocabulary, such as: Gregor Mendel, dominant, recessive,independent assortment, law of segregation, Punnett square, probability, incomplete dominance, codominance, multiple alleles, epistasis, polygenic inheritance, pedigree. ● performing specific processes, such as: ○ demonstrating independent assortment during gamete formation. ○ completing a Punnett square. ○ analyzing genotype and phenotype probabilities. 1: Student demonstrates a limited understanding or skill with the learning goal.

Gene Expression
DRAFT

Missouri Grade-Level Expectations (or other standards)
NGSS Science and Engineering Practices **2. Developing and using models** **High School TILS Strand IV: Tools of the Trade: Students will be able to use appropriate digital tools within and across content areas in preparation for post-secondary experiences.**

Learning Goal	Proficiency Scales
Students will be able to model gene expression.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● describing the regulation of gene expression in prokaryotic and eukaryotic organisms. ● building models that illustrate how bacterial operons work. ● performing bacterial gene transformation experimentally. ● demonstrating the regulation of gene expression. 2: The student demonstrates he/she is nearing proficiency by: ● recognizing or recalling specific vocabulary, such as: prokaryotic gene regulation, operon, promoter, operator, repressor, inducible, repressible, eukaryotic gene regulation, histones, methylation, acetylation, epigenetics, transposons, proto-oncogenes, oncogenes, tumor suppressor genes, differentiation, cytoplasmic determinants, homeotic genes, gene families. ● performing specific processes, such as: ○ labeling models that illustrate bacterial operons. ○ conducting bacterial gene transformation with limited success. 1: Student demonstrates a limited understanding or skill with the learning goal.

DNA to RNA of Protein
DRAFT

Missouri Grade-Level Expectations (or other standards)

NGSS: HS-LS-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurred during replication, and/or (3) mutations caused by environmental factors.

Learning Goal

Students will be able to model the flow of genetic information from DNA to RNA to the protein.

Proficiency Scales

4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal.

3: The student demonstrates mastery with the learning goal by

- applying the flow of genetic information to the synthesis of a protein.
- contrasting and comparing the processes of transcription and translation in prokaryotic and eukaryotic organisms.
- analyzing mutations to genetic material.

2: The student demonstrates he/she is nearing proficiency by

- recognizing and recalling specific vocabulary, such as: Beadle--Tatum experiment, RNA, mRNA, template strand, transcription, translation, codon, genetic code, tRNA, transcription factors, promoter, TATA box, introns, exons, spliceosome complex, anticodon, APE sites, mutations, mutagens.
- performing specific processes, such as:
- transcribing DNA into RNA.

	● translating RNA into protein by use of an mRNA codon chart. ● recognizing mutations. 1: Student demonstrates a limited understanding or skill with the learning goal.

DNA
DRAFT

Missouri Grade-Level Expectations (or other standards)
NGSS: HS-LS-1: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

Learning Goal	Proficiency Scales
Students will be able to analyze key scientific experiments to trace the discovery of DNA as the molecular basis of inheritance, the structure of DNA, and the method of DNA replication.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal as evidenced by ● labeling the components of the DNA molecule ● modeling DNA replication. ● evaluating the results of key scientific experiments.

	● predicting the results of key scientific experiments or alterations of key scientific experiments. 2: The student demonstrates he/she is nearing proficiency by ● recognizing or recalling specific vocabulary, such as: ● transformation, Hershey-Chase experiment, X-ray crystallography, Watson-Crick model of DNA, DNA replication, origin of replication, polymerases, leading strand, lagging strand, ligase, primer, primase, Okazaki fragments, nuclease, telomerase, histones, nucleosomes. ● performing specific processes, such as: ○ outlining the history of the discovery of DNA. ○ describing the outcome of key scientific experiments. 1: Student demonstrates a limited understanding or skill with the learning goal.

Chromosomes
DRAFT

Missouri Grade-Level Expectations (or other standards)

NGSS HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits from parents to offspring.
HS-LS-3: Apply concepts of statistics and probability to explain the variation in distribution of expressed traits in a population.

Learning Goal	Proficiency Scales
Students will be able to model the chromosomes relationship to genes and impact on traits.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by: ● analyzing crossing over events to create gene maps. ● solving sex-linked genetic problems. ● analyzing pedigrees. ● analyzing karyotypes. ● tracing mitochondrial inheritance patterns. ● tracing non-Mendelian epigenetic inheritance patterns. 2: The student demonstrates he/she is nearing the learning goal by ● recognizing or recalling specific vocabulary, such as: chromosome theory of inheritance, Morgan, linked genes, sex-linked genes, recombinants, cytological maps, sex determination, Barr body, nondisjunction, aneuploidy, genomic imprinting, mitochondrial inheritance. ● performing specific processes, such as: ○ solving sex-linked problems. ○ describing chromosomal inheritance. ○ determining pedigrees. ○ analyzing karyotypes. 1: Student demonstrates a limited understanding or skill with the learning goal.

Cell Reproduction

DRAFT

Missouri Grade-Level Expectations (or other standards)

NGSS HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Learning Goal	Proficiency Scales
Students will be able to explain how cells reproduce and replace themselves by a process known as the cell cycle, including understanding the role the cell cycle plays in growth, repair, and cancer.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery of the learning goal by ● diagramming cell reproduction. ● explaining the regulation of cell reproduction. ● explaining how regulation goes awry to cause cancer. 2: The student demonstrates he/she is nearing the learning goal by ● recognizing or recalling specific vocabulary, such as: cell cycle, chromosome, chromatid, interphase, mitosis, cell plate, cleavage furrow, checkpoints, cyclin, cyclin dependent kinases, MPF, density dependent inhibition, cancer, HeLa, metastasis. ● performing specific processes, such as: ○ describing cell reproduction ○ discussing the regulation of cell division. ○ describing the development of cancerous cells. 1: Student demonstrates a limited understanding or skill with the learning

	goal.

Biotechnology
DRAFT

Missouri Grade-Level Expectations (or other standards)
<Cut and paste...what MGLE correlates to the unit> **<May also include AP or ACC information here>**

Learning Goal	Proficiency Scales
Students will be able to apply the concepts of biotechnology.	4: Student demonstrates an in-depth inference or advanced application or innovates with the learning goal. 3: The student demonstrates mastery with the learning goal as evidenced by ● analyzing DNA restriction fragments, including use of restriction enzymes, and electrophoresis. ● simulating DNA sequencing. ● analyzing gene expression by use of microarrays. 2: The student demonstrates he/she is nearing proficiency by ● recognizing or recalling specific vocabulary, such as: cloning, plasmids, ligase, sticky ends, restriction enzymes, DNA restriction fragments,

	antibiotic resistance, polymerase chain reaction, electrophoresis, DNA fingerprinting, DNA microarray, transgenic organisms, GMO. ● performing specific processes, such as: ● performing a restriction digest experiment. ○ analyzing a DNA fingerprint. ○ modeling restriction enzyme activity. 1: Student demonstrates a limited understanding or skill with the learning goal.